the somatic divisions, the conclusion is drawn that this process represents a side-by-side conjugation of somatic chromosomes, which are separated at the first maturation division.

MOTTIER and NOTHNAGEL,[20] after a study of the pollen mother cells of *Allium cernuum*, come to very different conclusions regarding the conjugation process. These stand in agreement with the earlier accounts of MOTTIER, and may be summarized as follows. Synapsis is a real contraction of the linin net with its chromatin granules. The thick spirem which emerges therefrom shows only an occasional temporary split in some parts. Nothing is found to indicate a union of two spirems in the prophases. During a second contraction the spirem is thrown into loops, and cross-segmentation occurs. The bivalent chromosomes so formed are regarded as consisting of two somatic chromosomes previously arranged end to end in the spirem. The members of each bivalent separate at the first division and during anaphase become longitudinally split in preparation for the second. At telophase there is formed an interrupted spirem, but there is present no chromatin knot such as BONNEVIE has described and which MOTTIER and NOTHNAGEL believe to be due to improper fixation.

The above works recall the earlier researches of BERGHS[21] and of GRÉGOIRE[22] on *Allium fistulosum*, in which they found the bivalent chromosomes arising through a union of two spirems in the presynaptic or synaptic stages, as BONNEVIE later found in *Allium Cepa*. The figures given by these writers to illustrate these critical stages form a much more complete series than those accompanying the contribution of MOTTIER and NOTHNAGEL. It is hardly probable that the disagreement between these accounts is due entirely to the fact that different species of *Allium* were used.—L. W. SHARP.

Cytology of mutants.—Some of the cytological aspects of the *Oenothera* question are summarized by GATES[23] in a discussion of tetraploid mutants. *O. gigas*, a tetraploid form, in all probability arises through the apogamous development of an unreduced megaspore mother cell with 28 chromosomes ($4x$), such a cell having been seen by GEERTS. Triploid mutants seem to be due to the union of a diploid with a haploid germ cell (STOMPS, Miss LUTZ). In some plants the mutational changes are not confined to the meiotic divisions, but at

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[20] MOTTIER, D. M., and NOTHNAGEL, M., The development and behavior of the chromosomes in the first or heterotypic mitosis of the pollen mother cells of *Allium cernuum* Roth. Bull. Torr. Bot. Club **40**:555–565. *pls. 23, 24.* 1913.

[21] BERGHS, J., La formation des chromosomes hétérotypiques dans la sporogénèse végétale. II. Depuis la sporogonie jusqu'au spirèm définitif dans la microsporogénèse de l'*Allium fistulosum*. La Cellule **21**:383–394. *pl. 1.* 1904.

[22] GRÉGOIRE, V., La formation des gemini hétérotypiques dans les végétaux. La Cellule **24**:369–420. *pls. 2.* 1907.

[23] GATES, R. R., Tetraploid mutants and chromosome mechanisms. Biol. Centralbl. **33**:93–99, 113–150. *figs. 7.* 1913.

many different stages irregularities in chromosome distribution may occur in a variety of ways. GATES believes several characters of *O. gigas* cited by DE VRIES as occurring independently of chromosome doubling are the result of the tetraploid condition with its larger cells and nuclei. Many such differences are attributed to causes fundamentally quantitative. The interpretation of NILSSON, that *O. gigas* originates by the accumulation of factors for size, is held by GATES to be contradicted by the cytological facts and by the sudden origin of giant types with their subsequent wide variation. Although some *Oenothera* characters are Mendelian in their behavior after they appear, Mendelian combinations in NILSSON's sense are inadequate to account for their first appearance.—L. W. SHARP.

A heterosporous fern.—LIGNIER[24] has published a new genus (*Mittagia*) from the Lower Westphalian strata, which is the first heterosporous fossil fern to be described. That such a group did occur is, of course, postulated by the existence of the seed ferns, but this is the first demonstration of its presence. LIGNIER, too, has sounded a note of warning by his discovery. He was at first inclined to consider that his sections were of a pteridosperm, *Lagenostoma Lomaxi*, so similar in structure are the outer tissues of the sporangia in the two forms. When he found four megaspores to a sporangium, a stomium present, and the sporangia arranged in a sorus, he knew that he had something different. His sporangium, however, he considers did not dehisce, and so, like *Lepidocarpon*, is a stage toward the seed habit. His conclusion that the sporangia belonged to a fern is based chiefly on their structural resemblance to *Lagenostoma*, and on their arrangement in a sorus. He has further distinguished them from the lycopod and equisetum lines, from *Lepidocarpon*, *Miadesmia*, *Selaginella*, heterosporous calamites, etc. LIGNIER's intensive study of the small amount of material at his disposal and his logical deductions are exceedingly interesting and valuable.—R. B. THOMSON.

Evaporation in Skokie Marsh.—Using the Livingston atmometer, SHERFF[25] measured the evaporating power of the air in a marsh habitat near the city of Chicago during the summer of 1911. The average daily rate of evaporation for the lowest stratum of vegetation was 3 cc. for the *Typha* association, 4.27 cc. for the reed swamp, 4.5 cc. for the swamp meadow, and 7.9 cc. for the swamp forest of *Quercus bicolor* and *Fraxinus americana*. This forest is normally antecedent to a truly mesophytic forest such as that found by the reviewer to have an average daily rate of 8.1 cc.[26] During September and October of the

[24] LIGNIER, O., Un noveau sporange séminiforme. Mém. Soc. Linn. Normandie **24**:49–65. 1913.

[25] SHERFF, E. E., Evaporation conditions at Skokie Marsh. Plant World **16**:154–160. 1912.

[26] BOT. GAZ. **52**:193–208. 1911.